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OIL POSSIBILITIES OF THE GALESBURG QUADRANGLE, KNOX AND WARREN COUNTIES, ILLINOIS

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INTRODUCTION

Geological studies in the Galesburg quadrangle, conducted by the Illinois State Geological Survey during the summer of 1926, have made available information bearing on the oil possibilities of that area. The purpose of this paper is to give the oil industry immediate access to recent data and their interpretations.

The location of the Galesburg quadrangle with reference to the State as a whole and to the nearest oil-producing area, the Colmar-Plymouth oil field, is shown in figure 1.

GENERAL GEOLOGY

The Galesburg quadrangle is situated near the northwestern margin of the Illinois coal field. It is joined on the northwest by the Alexis quadrangle,¹ and on the south and southeast by the Avon and Canton quadrangles.² The area is everywhere covered by a mantle of glacial drift except along the larger stream courses. The thickness of the drift varies from that of a thin layer to slightly more than 100 feet. Virtually the entire area is underlain by Pennsylvanian rocks whose thickness varies from almost nothing to 295 feet. In the southwest portion of the area the Burlington limestone (chert) of Mississippian age is exposed. A few well logs show the Burlington but generally the Pennsylvanian rocks rest unconformably upon the Sweetland Creek shale of Devonian age. The Kinderhook shale reported in the Alexis quadrangle, in the Avon and Canton quadrangles, and in the Monmouth quadrangle on the west was not encountered in the wells of this quadrangle but only eight drillings have penetrated its horizon. Six are in the city of Galesburg, one in Knoxville, and one in Abingdon for

¹ Wanless, H. R., Oil possibilities of the Alexis quadrangle, Mercer and Warren counties, Illinois: Illinois State Geol. Survey Press Bulletin Series, Illinois Petroleum No. 8, pp. 1-7, April 16, 1927.

² Savage, T. E., Geological structure of Canton and Avon quadrangles: Illinois State Geol. Survey Bull. 33, 1916.



FIG. 1. Index map of Illinois showing location of Galesburg quadrangle and of the Colmar-Plymouth oil field.

which no complete log is available. Such limited drilling does not establish the absence of this formation throughout the area. In some of the wells the Kinderhook shale may not have been distinguishable from the underlying Sweetland Creek shale. Usually, however, the latter formation may be recognized by the presence of the tiny spore cases, *Sporangites huronense*.

STRUCTURE

Figure 2 is a structure contour map based on datum points on the top of Colchester (No. 2) coal obtained from outcrops, coal-test borings, and wells penetrating the coal. No. 2 coal underlies most of the area with an average thickness of about 30 inches. Its association with certain overlying beds makes its identification relatively easy and it therefore serves as a good key horizon. In the outcrops the elevation of the coal was determined by telescopic level and plane table in part, and in part by hand leveling from known elevations. In places where Colchester (No. 2) coal was buried or had been removed by erosion its probable elevation was calculated from the standard section present. Points so determined are not numerous and are considered accurate within 20 or 30 feet. The probable error in the points determined instrumentally is considered to be less than 20 feet. The data from coal-test boring are not considered extremely reliable. Most of the test drillings were made by the churn-drill method and the results are subject to variations of 5 or 10 feet, depending partly upon the length of the stem used in drilling.

Many minor undulations occur in the coal some of which are thought to be due to unequal settling of the coal and associated strata, and possibly some are due to ice-shoving produced by the overriding ice in Pleistocene time. In one place near the western edge of the quadrangle the latter cause was proved to have produced a slight warping of the strata. These minor undulations have been avoided, as far as possible, in constructing figure 2, and only the broader, more significant structural features have been included.

The structures favorable to oil accumulation have been named for convenience and brevity in description (fig. 2).

Haw Creek dome near the center of the quadrangle is a pronounced anticlinal structure plunging to the southeast. The dips of 20 feet on the north of the structure and 80 feet on the northeast should furnish sufficient reversal of dip to favor accumulation in the top of the dome provided migration occurred on a regional scale from the southeast. The small domal feature on the southeastern extension of Haw Creek dome may be a part of the main dome. The saddle between the two bulges is not well defined.

Court Creek dome in the northeast part of the quadrangle is separated from Haw Creek dome by a broad, shallow syncline which plunges to the

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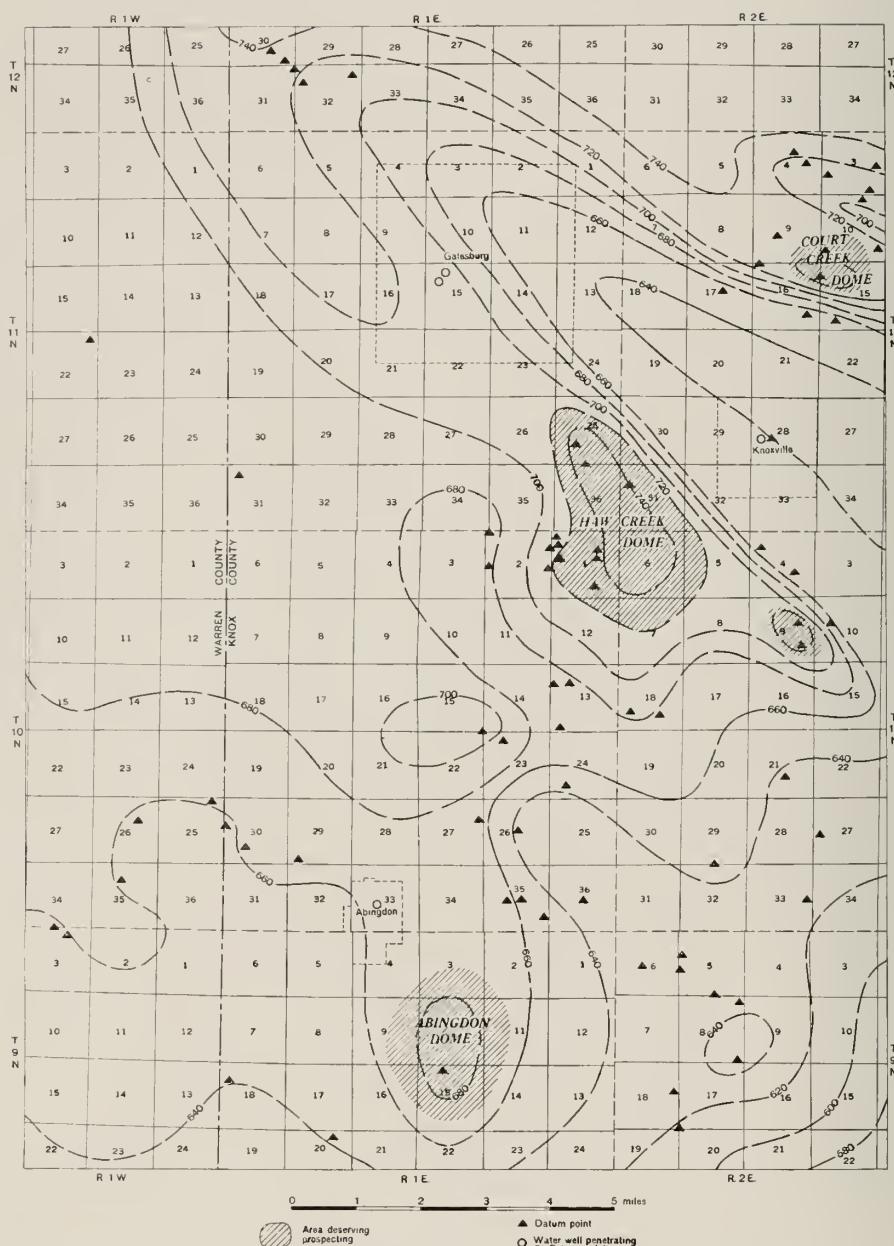


FIG. 2. Structure map of the Galesburg quadrangle. Key horizon, top of Colchester (No. 2) coal. (By R. S. Poor, Illinois State Geological Survey.)

southeast. The Court Creek dome is thought to be merely a part of a somewhat larger anticlinal nose plunging eastward. The steep dip on the south suggests that the dome may be structurally similar to Haw Creek dome.

Abingdon dome in the southern part of the quadrangle is a broad, low anticlinal nose pitching south. It probably flattens out in the Avon area to the south although the structure is not definitely indicated on the map of that area. The data are too few to outline this structure accurately.

PREVIOUS DRILLING

To date no deep oil tests have been drilled in the Galesburg quadrangle. A test is reported to have been made near Maquon about 12 miles east of Abingdon, but details have not been secured. One of the six deep water wells in Galesburg penetrated the Dresbach (Cambrian) sandstone and attained a depth of 2305 feet. The remaining seven deep wells in the quadrangle were carried into the St. Peter (Ordovician) sandstone.

None of these wells is considered to have been drilled on favorable structure; so their logs would be of small value aside from giving the stratigraphic sequence. The following general section summarizes the stratigraphic data from all of the deep wells.

General stratigraphic section of the Galesburg quadrangle based on the logs of 8 deep wells

System	Formation	Thickness Feet	Character of rocks
Pleistocene	0-125	Pebbly clay, sand, and gravel.
Pennsylvanian	Carbondale Pottsville	0-295	Sandstones, shales, limestones, and 2 workable coal beds.
Mississippian	Burlington	0-50	Crinoidal limestone, very cherty.
	Sweetland Creek	70-140	Shale, gray and brown, contains <i>Sporangites huronense</i> .
Devonian	Cedar Valley Wapsipinicon	70-175	Limestone, shaly, brown to light gray.
	Niagaran	35-50	Chert in upper part. Lower 10-15 feet a light gray, porous dolomite.
Silurian	Hoing sand	?	Producing sand in Colmar-Plymouth field.
	Maquoketa	105-275	Shale, light bluish-gray, with thin dolomite layers.
	Galena ("Trenton") Platteville	385-420	Dolomite, brown, finely crystalline, lower 10 feet sandy.
	Glenwood	?	A bluish shale horizon-marker in some areas.
Ordovician	St. Peter	175	Sandstone, white, loosely cemented.
	Shakopee	255	Dolomite, fine-grained, light gray and pink, cherty, with sandy layers.
	New Richmond	15	Sandstone, white, showing secondary growth.
Prairie du Chien	Oneota	225	Dolomite, cherty, white and light gray.
	Jordan	30	Sandstone, white, very dolomitic.
	Trempealeau	295	Dolomite, pink, purple, and gray, glauconitic; no chert.
Cambrian	Franconia	205	Sandstone, green, dolomitic; glauconitic; with layers of shale and dolomite.
	Dresbach	70	Sandstone, yellow to white; base not reached by drill.

POSSIBLE OIL-BEARING HORIZONS

Three formations in the Galesburg quadrangle may produce oil in commercial quantities.

(1) The Cedar Valley and Wapsipinicon limestones should be reached at a depth of about 600 feet below the surface. This porous horizon has not given shows of oil in any well passing through it. It is known to be a good aquifer, however, but the water is reported to be of low salinity. It is not likely to contain more than local lenses of oil-bearing strata even under the best of conditions.

(2) The Hoing-sand horizon occurs at the base of the Niagaran dolomite and is the producing bed in the Colmar-Plymouth field to the southwest. This sand is known to be lenticular in distribution. It was probably derived from the residual material that was developed on the surface of the Maquoketa shale during the long period of erosion prevailing in this region between the end of the Maquoketa and the beginning of Niagaran time. If this explanation be true then the advancing Niagaran sea in reworking this residual material would naturally deposit the sand therefrom in the depressions on the old Maquoketa surface. Sediments deposited along the plane of unconformity between two otherwise contiguous beds are usually in lenses and are difficult to prospect. The only guide for locating production in such lenses is favorable structure. The sand may or may not be present on the structure, and if present it may or may not be oil-bearing. The probability of accumulation in reservoirs of this sort, however, is good. The fact that the Hoing sand, as such, has not been definitely located in any deep well in the Galesburg quadrangle does not establish its absence elsewhere. The lower 10 or 15 feet of the Niagaran dolomite is porous. The Niagaran is usually about 40 feet thick in this area and may be reached at a depth of approximately 800 feet.

(3) The Platteville-Galena ("Trenton") dolomite appears to present the most favorable possibilities for the accumulation of oil in commercial quantities. Salt water is reported from this formation rather generally in this part of the State, and shows of oil have been reported in it in the Alexis quadrangle. One of the St. Peter wells in the city of Galesburg had good shows of oil in the lower 300 feet of the formation. In this particular well the Platteville-Galena was 410 feet thick, and the top was reached at a depth of 650 feet. The maximum known depth to the top of the Galena is 1110 feet.

Certain precautions are essential to prospecting in this area. It should be borne in mind that the formations of the area have a small regional dip to the east and southeast and consequently occur at greater depths than in McDonough County or in any area to the west. Also, the variation in thickness of the formations, as indicated in the general section, should be taken into account. For instance, the top of the Niagaran may be reached at

depths varying from less than 200 feet to slightly less than 800 feet. Depths to other formations are known to have similar variations.

FIXED CARBON RATIOS

The ratio of fixed carbon to the sum of fixed carbon plus volatile matter determined from coal analyses is called the "Fixed carbon ratio." It is an index of the amount of metamorphism or folding that has occurred in an area. In his paper on the significance of carbon ratios in relation to the petroleum in Illinois³ Moulton pointed out that the extension of high carbon ratios, based on No. 6 coal, which projects northwest from central Tazewell County through Knox County to Rock Island County enclosed an area worthy of more consideration than had been given to it. Two analyses of Rock Island (No. 1) coal samples taken from the new mine of the Galesburg Mining Co. 4 miles east of Galesburg were obtained by the present writer. They show carbon ratios of 53.5 and 52.3. The amount of fixed carbon is therefore notably higher in this coal than in the coal of many other portions of the northern part of the Illinois coal basin. This condition would appear to indicate that the area had been subjected to more than the usual amount of folding generally recognized for it.

RECOMMENDATIONS FOR TESTING

The Abingdon dome, Court Creek dome, and Haw Creek dome are recommended for further investigation. The first two are outlined on very incomplete data. Therefore two or more shallow tests might be justified to give a better outline of the structure before deeper drilling is attempted. If such shallow tests are made, they should be carried to the contact of the Sweetland Creek (Devonian) shale and the Cedar Valley (Devonian) limestone. This is the shallowest pre-Pennsylvanian guide horizon which will be encountered at all points within the quadrangle. Depths to it on these structures should range from 400 to 625 feet. Haw Creek dome is much better delineated by the available data and as a "wildcat" a deep drilling to test the Galena ("Trenton") might be attempted. Depths to it should range from 850 to 1025 feet.

On the basis of the available data, test drilling through the Platteville-Galena dolomite is recommended. Only the upper portion of this rock is the well-known "Trenton" but the Platteville or lower portion is also porous and has given shows of oil. The contact of this formation with the underlying blue Glenwood shale or St. Peter pure-quartz, loosely cemented sandstone is easily recognized in all logs. None of the deep water wells thus far drilled within the area is considered favorably located to adequately test the structures. It should be pointed out that the Waterloo field in Monroe County, approximately 180 miles south of the Galesburg quadrangle, is the nearest one where production is obtained from the "Trenton."

³ Moulton, G. F., Carbon ratios and petroleum in Illinois: Illinois State Geol. Survey Report of Investigations No. 4, 1925.